

NOTICE

OF A

COLLECTION OF FISHES

FROM THE SOUTHERN BEND

OF THE

TENNESSEE RIVER, ALABAMA.

By L. AGASSIZ.

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## ON FISHES FROM TENNESSEE RIVER, ALABAMA.

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THE only information we have at present upon the fishes of the Tennessee River, has been published by Dr. D. H. Storer, who mentions nine species from the vicinity of Florence, Alabama, in the Proceedings of the Boston Society of Natural History for 1845; and of which short descriptions appeared in his Synopsis of the Fishes of North America, in 1846. Having lately received a collection of not less than thirty-three species from the same water system, brought together by the untiring efforts of Dr. Newman, of Huntsville, who has most kindly placed them in my hands for description, it seems desirable that an early notice of the general character of the ichthyological fauna of that region should be published, to serve as a standard of comparison with the fishes of the other western and southern rivers, in the study of their geographical distribution. I arrange them below according to their natural affinities.

**PERCOIDS, Cuv.**—Whether the genera *Perca*, *Labrax*, and *Lucioperca*, are really wanting in the Tennessee River remains to be ascertained. No specimens of these genera were found among those forwarded by Dr. Newman; though many less conspicuous forms were collected. Thus far the genera *Grystes*, *Centrarchus*, and *Pomotis*, as understood at present by ichthyologists, are the only representatives of the family of Percoids in the Tennessee River.

1. **GRYSTES, Cuv.**—I have already shown in my "Lake Superior" that the genera *Grystes* and *Huro* of Cuvier do not differ essentially one from the other, and must therefore be united into one natural group; moreover when the fishes of Kentucky shall be better known, it may become necessary to substitute for either of them the name of *Lepomis*, introduced in ichthyology by Rafinesque, as early as the year 1820, for the western species of this genus. If I hesitate to make the change now, it is simply because I have not the means of deciding upon the value of his many species. The species of this group are indeed very difficult to characterize. They differ chiefly in the relative size of their scales, the presence or absence of teeth upon the tongue, though Cuvier denies the presence of teeth on the tongue of any of



them, &c. There are besides marked differences between the young and the adults. These circumstances render it impossible to characterize any one species without comparative descriptions and figures. The species from Huntsville, known there under the name of Trout, differs equally from the northern species mentioned in my "Lake Superior," and from that of the Southern States described by Cuvier and Valenciennes as *Grystes salmoneus*. Its snout is shorter, the posterior end of the upper maxillary extends beyond the hinder border of the eye, the head is higher, and the scales much larger in the dorsal as well as in the ventral regions. No teeth on the tongue. I call this species provisionally *Grystes nobilis*, Ag. It reaches a large size, and weighs occasionally from ten to fourteen pounds.

2. *CENTRARCHUS*, Cuv.—Under this name Cuvier has combined a variety of Percoids agreeing in general form; their body being oval and compressed, and the two dorsals continuous; but these fishes differ from one another in so many respects that they require to be further subdivided.\* I shall retain the name of *Centrarchus* for that group of species of which *Centrarchus irideus* may be considered as the type. Thus circumscribed, the genus *Centrarchus* may be characterized as follows: Body very broad, greatly compressed, above as well as below. Dorsal long and high, gradually rising, without a depression between the spinous and soft rays; spinous portion of the fin largest. Anal shaped like the dorsal, but with fewer spinous rays, extending between the ventrals. Mouth small. No species of this genus has been found in the Tennessee River.

3. *POMOXIS*, Rafin.—This genus was established by Rafinesque for a species closely allied to the *Centrarchus hexacanthus* of Cuv. and Val., and it well deserves to be retained. The body is much elevated and compressed, resembling somewhat *Centrarchus* proper. Like that genus it has a high dorsal and a high anal, of nearly equal size, and the spinous portion of these fins rises towards the soft rays without a depression; but in *Pomoxis* the soft portion of these fins is much the largest, whilst it is the smaller in *Centrarchus*; in *Pomoxis* the lower jaw is very prominent. The mouth is very large, which is smaller in *Centrarchus*. I have found representatives of this genus in all the Western States, from the western parts of New York to the Gulf of Mexico, and in the southern Atlantic States, but none in the northern Atlantic States. The species from the Tennessee River, called there Speckled or White Perch, agrees fully with the description given by Rafinesque of his *Pomoxis annularis*, with the sole exception of a golden ring at the base of the tail, which may be

\* DeKay has contrived to render the genus *Centrarchus* of Cuvier still less natural, by introducing into it his *Centrarchus fasciatus* and *obscurus*, which truly belong to the genus *Grystes*. See "Lake Superior," page 295.

faded in the specimens sent by Dr. Newman, from Huntsville. Not having however specimens from the locality quoted by Rafinesque, I must leave it for further investigations to determine beyond any doubt their specific identity or difference. *Centrarchus hexacanthus*, Cuv. and Val., belongs unquestionably to this genus.

4. AMBLOPLITES, *Rafin.*—This is another of the natural genera established by Rafinesque for one of the many distinct types combined by Cuvier and Valenciennes under the name of *Centrarchus*. The well known *Centrarchus æneus* may be considered as its type, though Rafinesque founded his genus upon another species, from Kentucky, which has remained unnoticed since. The genus Ambloplites is easily distinguished from the preceding ones by the structure of its dorsal and anal fins. The spinous portion of the dorsal is much longer than the posterior soft portion of that fin and scarcely half its height, causing a marked depression to appear between the spinous and the articulated rays. The same is the case with the anal, which is also long; but low in its anterior spinous portion. The general form of these fishes is oval, and the body less compressed than in the preceding genera. The species from the Tennessee River agrees in every respect with Rafinesque's *Ambloplites ichtheloides*. It is called at Huntsville Goggle-eyed or Black Perch. In adopting the genus Ambloplites and referring this species to it with Rafinesque's authority I have acted with that discretion due to an author who labored under the greatest difficulties when preparing his work upon the fishes of the Ohio. It is true he himself describes this species as *Lepomis ichtheloides*; but he also suggests the desirableness of distinguishing it generically and proposes a new name for the genus, should it be admissible. Finding it to be so, I do not hesitate in giving him the fullest credit for his suggestion, even though I must add that he has described another variety of the same species under the name of *Ichthelis erythrops*. I have found both these varieties among the fishes sent to me by Dr. Newman, and I have no hesitation in considering them as specifically identical with one another and as agreeing fully with Rafinesque's descriptions. Should naturalists be more generally inclined to correct simply what they consider as errors in their predecessors instead of discarding altogether what they can not at once determine, we should have much fewer of those nominal species in our descriptive works, which are the curse of our scientific nomenclature. *Ambloplites ichtheloides* is much stouter and more elongated than *Ambl. æneus*; body less compressed above; face broader, lower jaw less prominent, and strongly arched from side to side; mouth opens less obliquely upwards; spinous rays of dorsal and anal shorter than in *A. æneus*; dorsal sprinkled with white spots.



5. *CALLIURUS*, Rafn.—Among the many Percoids found in the freshwaters of the United States there is one very common in South Carolina, which was first described by Cuvier and Valenciennes under the name of *Pomotis gulosus*, and afterwards referred by them to the genus *Centrarchus*. This species however belongs neither to *Centrarchus* nor to *Pomotis*, if we are to consider genera as expressing the same general features under a variety of modifications; for all true *Pomotis* are fishes with a small mouth, feeding on worms, while *P. gulosus* has a large mouth like *Grystes* and is a voracious animal living upon small fishes, which he chases with great energy. Again, *Centrarchus* has fins widely different in their structure from those of *P. gulosus*; there being a large number of spinous rays in advance of the anal in *Centrarchus* proper and those genera mentioned above which have been finally separated from *Centrarchus*; whilst *P. gulosus* has only three, like the true *Pomotis*. Notwithstanding these peculiarities I have been hesitating for a long time to consider *P. gulosus* as the type of a distinct genus, until I ascertained that there exist many species of this type in different parts of the country, all of which reproduce the essential peculiarities of *P. gulosus* under a variety of modifications. Upon a careful investigation of all the works in which American fishes are mentioned, I ascertained however that Rafinesque had already established a distinct genus for a species of this type described in his *Ichthyologia Ohiensis* under the name of *Calliurus punctulatus*. It is hardly surprising that this genus should have been overlooked by European ichthyologists and that it should even have escaped the notice of the authors of the great French *Histoire naturelle des Poissons*, for the fishes of the Ohio river have remained entirely unnoticed since Rafinesque, until Dr. Kirtland published his interesting and highly valuable papers upon the fishes of Ohio, in the Journal of the Natural History Society of Boston. Dr. Kirtland however, though the first author who has done full justice to the valuable contributions of Rafinesque to the Ichthyology of the United States, does not mention the species described by Rafinesque, as *Calliurus punctulatus*, and so this genus has remained unnoticed until now. It has occurred to me that it would be but justice to a naturalist, whose labors have been so generally neglected, to call the attention of Ichthyologists to these facts. I subjoin a short diagnosis of the genus *Calliurus*: Body oval, rather elongated, not compressed above. Dorsal long and low in its anterior portion, with a slight depression between the spinous and soft rays; posterior portion of the dorsal shorter than the anterior, though higher. Anal not half the size of the dorsal, with only three spinous rays. Mouth large, opening somewhat upwards, the lower jaw being longer than the upper. The species from Huntsville is identical with Rafinesque's *Calliurus punctulatus*. It is called there Black Perch or Goggle-eye.

6. *POMOTIS*, *Rafin.*—Every ichthyologist must be familiar with the freshwater sunfishes, so common throughout the United States; but it is perhaps not so generally known that the authority to which the genus *Pomotis* ought to be ascribed is questionable. Indeed, I find it universally ascribed to Cuvier: but that name occurs already in Rafinesque's *Ichthyologia Ohiensis*, published in 1820, as a subgenus of his genus *Ichthelis*, which he there divides into *Telipomis* and *Pomotis*. It seems therefore probable to me that Cuvier not considering these subdivisions necessary, and finding the name *Pomotis* better adapted to express the prominent character of all the species of this group, adopted the name of *Pomotis* in preference to *Ichthelis*, and in conformity with an objectionable practice, followed by some naturalists, to which Cuvier however did not adhere in other instances of applying a new authority whenever the range of a genus is modified, allowed in this case his name to supersede that of Rafinesque, which I would however restore, in conformity with the more just practice now prevailing. If it were further asked, what should be done with the name of *Ichthelis* which was proposed by Rafinesque as early as 1818. Whether it should be made a synonym of his own subgenus *Pomotis*? or disregarded altogether, because *Pomotis* has come into general use? I would suggest that neither would be the proper course to follow. It is my opinion that in a complete monograph of this group, the name *Ichthelis* should be finally restored to its right and *Telipomis* and *Pomotis* used for such sections or genera as it may become necessary to separate from it, now that the number and diversity of species of this group has increased beyond expectation. This is at least the course I shall adopt when publishing the descriptions of the many new species of this type I have collected in the Southern States. For the present, I limit myself to describing the seven species sent to me by Dr. Newman, six of which are new to science.

1. *Pomotis sanguinolentus*, Agass.—Called Sun Perch at Huntsville. The general outline of the body is that of *Pomotis nitida*, *Kirtl.*, but the back is more compressed, the dorsal and anal fins are more pointed behind, and the spinous rays are longer, the base of the anal is shorter. The sides of the head are marked with irregular undulating longitudinal lines of a metallic steel blue color, extending from the cheeks across the gill cover to the base of the pectorals and even continuing along the sides of the body in dotted lines. There are generally four of these lines below the eyes, the first being close to its margin, and extending backwards along and around the border of the opercular appendage and returning, meets the centre of the hinder margin of the eye, but reappears immediately in front of the eye and continues to the edge of the upper jaw. Though the opercular appendage is



rather large, the lateral line is so high near the back, that it is not covered by it anteriorly. The general color is of a reddish brown, mottled with red above and passing gradually into a uniform bright brick-red color prevailing upon the lower part of the body, and sprinkled with irregular light dots.

2. *Pomotis inscriptus*, Agass.—Small species, the outline of which is more elongated than in *P. sanguinolentus*. The gill covers are marked as in that species with three or four lines of a metallic steel blue color; opercular appendage long, directed more obliquely upwards than in any other species here described, black, with a light border which is a continuation of two of the lines of the cheeks, the one running below the eye, the other terminating behind the eye. Each scale of the back and sides is marked in its centre with a short narrow black line, hence the sides are regularly striped with dark interrupted lines as numerous as the rows of scales. Spinous rays all comparatively long and slender; the passage from the anterior to the posterior part of the dorsal gradual. All the fins except the pectorals are tinged with black at the extremity. General color dark olive above, lighter beneath.

3. *Pomotis notatus*, Agass.—Called Pond Perch at Huntsville. Body more elongated than in *P. vulgaris*; its upper and lower curve nearly equal. Opercular appendage very short, not extending beyond the base of the pectorals; its hinder margin is orange-colored, with a black spot in front, from which a faint dusky band extends to the eye. The spinous rays of the dorsal and anal are more slender than in *P. vulgaris*, and the articulated rays are crossed by fewer dotted or broken dark lines. The pectoral fins are long, extending beyond the base of the anal, as in *Ichth. macrochirus*, Raf. The color is of a uniform light olive; the sides, gill cover and belly being silvery; scales not dotted with black as in many similar species.

4. *Pomotis incisor*, Val.—Also called Pond Perch at Huntsville. This species resembles very closely the preceding, and is considered the same by the fishermen; but its profile is more arched and slants more abruptly; the black opercular appendage is not encircled with a brighter margin. Sides of the head not banded, but of a uniform color throughout. Dorsal and anal not banded, but darker colored than in the preceding species. There is moreover a dark black spot near the base of the hind rays of the dorsal in *P. incisor* which is wanting in *P. notatus*. General color of the body the same in the two species.

5. *Pomotis obscurus*, Agass.—Also called Pond Perch at Huntsville. Resembles *P. incisor* in the outline of the body, except that the profile is still more precipitate and the body somewhat more elongated as well as much stouter, especially in the region



of the head and across the pectorals. The opercular appendage is longer and broader, but also without a light posterior margin. The posterior soft rays of the dorsal are marked with a black spot as in the preceding species, but all the spinous rays of that fin are shorter and stouter. It is a dark colored fish throughout the lower as well as the upper side of the body, almost uniformly brown, the belly only being somewhat lighter in hue. The face and lower jaw are of a leaden color. The fins are all darker than in *P. incisor*, especially the ventrals.

6. *Pomotis bombifrons*, Agass.—Body higher than in *P. obscurus* and profile even more arched. Forehead prominent especially over the eyes. Head quite broad and short. Opercular appendage black, and small; a light narrow band runs along its lower margin. No black spot upon the hind part of the dorsal. The last spinous rays of this fin are shorter than in *P. obscurus*, thus making the passage to the soft rays more abrupt and marked, the soft portion of the fin being almost as prominent as in *Ambloplites* and *Calliurus* when compared with the spinous rays. Body light brown, fins lighter colored; scales of the belly and sides dotted with golden orange. The face and under jaw have not the leaden color of *P. obscurus*. Considering the peculiar form of the vertical fins and of the forehead, it may become necessary to separate this species from the other *Pomotis*. Indeed, I know already several species which agree in these respects with one another and must at all events form a distinct group in the genus.

7. *Pomotis pallidus*, Agass.—This species resembles *P. incisor* in the outline of the body, the nature and coloration of the scales, and in the size and form of the fins, but it differs greatly from it by its large mouth, the free extremity of the upper jaws reaching the vertical line of the middle of the eye, by the presence of teeth upon the palate, and by the ventral fins being placed immediately under the pectorals. The black opercular appendage which is very short, has a narrow orange border behind. There is a black spot at the base of the posterior rays of the dorsal. Both dorsal and anal are marked by one or two dark stripes; the caudal is crossed by several dotted vertical lines. There are eight or nine dusky bars across the sides, between the head and tail. This species bears the same relation to *Pomotis*, that *Pomoxis* bears to the true *Centrarchus*, in the size of the mouth, and the form of the body, and I have no doubt it will some day become the type of a distinct genus.

ETHEOSTOMOIDS, Agass.—There are comparatively few natural families in the animal kingdom so limited in their geographical distribution as to be entirely circumscribed within the boundaries of a single continent, and these few belong mostly to the type of Vertebrata. Though among fishes we should least ex-

pect such local groups, considering the greater uniformity of the conditions of existence prevailing in the medium they inhabit, when compared with the main land, yet there are several families of this class, the geographical range of which is quite limited. I need only mention the Gomiodonts of South America, the Labyrinthici of the Indian Ocean and the Sunda Islands, the Lepidosteii of North America, &c. Another natural family thus located within narrow limits is that of *Etheostomoids*, which I have for the first time characterized in my work "Lake Superior," p. 298. This family is founded upon the genus *Etheostoma* of Rafinesque, to which are added the genera *Pileoma* and *Boleosoma* of Dekay (of which the genus *Percina* of Haldeman is a synonym) and my genus *Pæcilichthys*.\* The three first of these genera were referred by their authors to the family of Percoids; but the absence of an air-bladder and of pseudobranchiæ, and the incomplete suborbital arch precludes such an association. Indeed these fishes are more closely allied to the true Cottoids and in particular to the genus *Gasterosteus* than to the Percoids, though the want of connection between the single suboperculum and the preoperculum forbids also a more intimate alliance with that family. The form of the ventrals of the *Etheostomoids* reminds us somewhat of those *Gobioids* in which the two ventrals are distinct. Since the publication of the work above mentioned, I have become acquainted with three new genera of this family, for which I would propose the names of *Hyostoma*, *Catonotus*, and *Hadropterus*.

The more extensive knowledge I have acquired of this family by these recent accessions enables me to give more precision to the characters assigned at first to its genera; as follows:

1. *ETHEOSTOMA*, Rafin.—Head elongated pointed; mouth terminal, widely open, not protractile, broad; jaws of equal length. Opercular apparatus and cheeks bare. First dorsal distinctly separated from the second. Anal and second dorsal smaller than the

\* The genus *Pæcilichthys* was first mentioned under the name of *Pæcilosoma*. Being however at the time of its publication far away from Cambridge, and unable to consult my library or any other, I did not perceive that that name was already preoccupied; I would therefore change it now to *Pæcilichthys*. Several new species of this genus have been discovered since. One described by Dr. Kirtland as *P. erythrogaster* from the vicinity of Cleveland, Ohio. Ann. of Sci., Jan., 1854, p. 4. Another collected by Mr. Geo. Stolley in the Osage River, Mo., remarkable for its brilliant colors, the body being light brown, with dark black lines upon the sides of the back and with broader transverse bands alternately black and orange red, especially bright upon the sides of the tail; dorsals banded with black, white and red. I call this species *P. spectabilis*. Another found by Dr. L. Watson in small creeks near Quincy, Illinois, similar in color to the preceding but without black stripes along the back, also less compressed. I call this species *P. versicolor*. Specimens of this species were also received from Osage River. A fourth species from the Osage River, Mo., also discovered by Mr. Geo. Stolley, is of a greenish color mottled with black, the second dorsal, the caudal, the anal, the ventrals and the pectorals being dotted all over with minute dark specks. I call this species *P. punctulatus*.



first dorsal, but equal to one another. Caudal lunate. Type of the genus: *Ethblennioides*, Raf.

2. CATONOTUS, Agass.—Head elongated, obtuse; mouth terminal, widely open, not protractile, lower jaw longer than the upper. Opercular apparatus, cheeks and neck destitute of scales. First dorsal much lower than the second, with clubshaped rays when full grown; membrane of this fin extending to the base of the second dorsal. Anal smaller than the second dorsal. Caudal rounded. Only one species known: *C. lineolatus*, Agass., discovered by Dr. L. Watson in small creeks near Quincy, Ill. The whole body olive green with close narrow interrupted black longitudinal lines; transverse lines of the same color across the caudal.

3. PILEOMA, DeKay.—Head conical, pointed, truncated at the end, in form of a hog's snout; mouth moderate, in form of an oblique arc of a circle, opening below the end of the snout, very slightly protractile. Lower jaw shorter than the upper. Operculum and cheeks scaly. Membrane of the first dorsal not reaching the base of the second. Anal smaller than the second dorsal. Caudal truncate or slightly lunate. Type of the genus: *P. caprodes*. (*Etheostoma caprodes*, Rafin.)

4. HADROPTERUS, Agass.—Head conical, obtusely pointed, rounded at the end; mouth moderate, terminal, not protractile, jaws nearly equal. Operculum and cheeks scaly. Membrane of the first dorsal extending to the base of the second. Anal and second dorsal large and equal. Caudal truncate or slightly lunate. Only one species known: *H. nigrofasciatus*, Agass. From the neighborhood of Mobile, Alabama. Discovered by Albert Stein, Esq. Brown above, lighter below, with transverse black bands, wider in the middle than nearer to the back or the belly.

5. HYOSTOMA, Agass.—Head short, blunt, rounded, with swollen cheeks. Mouth comparatively small below the snout, slightly protractile. Lower jaw shorter than the upper, which may be concealed in a deep furrow below the snout. Opercular apparatus and cheeks scaly. First dorsal long, but not reaching the base of the second. Anal smaller than the second dorsal. Caudal slightly lunate. Only one species known: *H. Newmanii*, Agass. Discovered by Dr. Newman in the vicinity of Huntsville, Alabama, where it is called "*Salmon*." This fish is uniformly brown with irregular transverse black blotches. A red stripe along the base of the first dorsal.

6. PÆCILICHTHYS, Agass.—Head short and strong, tapering into a rounded snout. Mouth terminal, proportionally broad, not protractile, though the maxillary bone be moveable. Opercular apparatus scaly, cheeks bare. First dorsal distinctly separated from the second. Anal smaller than the second dorsal. Caudal truncate or slightly rounded. The species of this genus are among



the most brilliant freshwater fishes in the world. Type of the genus: *Etheostoma variatum*, Kirtl. Several new species are mentioned in the note above.

7. *BOLEOSOMA*, *Dekay*.—Head short, rounded; mouth below the end of the snout, small, horizontal, slightly protractile. Opercular apparatus and cheeks scaly; neck scaleless. Membrane of the first dorsal reaching the base of the second, though the two fins are distinctly separated. Second dorsal much larger than the anal. Caudal rounded. Type of the genus: *Bolosoma tessellatum*, Dekay. For references to other species, see "Lake Superior," page 299.

All the representatives of this family are confined, as far as we know, to the fresh waters of North America; not a single species having thus far been noticed either in Europe or Asia. To this circumstance we must no doubt ascribe the total neglect of the genus *Etheostoma* of Rafinesque by European ichthyologists.

The genus *Hyostoma* is the only type of this family I am acquainted with from the southern bend of the Tennessee River. It is true, Dr. Storer has described two species of *Etheostoma* from the vicinity of Florence, Alabama, but they do not seem to occur farther east; at least I have found nothing to remind me of his species in the collection forwarded by Dr. Newman.

It is a fact worthy of notice that not a single species of *Gasterosteus* has as yet been discovered in the Mississippi River or its tributaries, or in any of the rivers emptying into the Gulf of Mexico. I have also searched in vain for them in the southern Atlantic states, though they are common in the northern states and in the waters emptying into the St. Lawrence.

*SCLENIDS*, *Cur*.—In the old world no representative of this family is known to inhabit the freshwaters, whilst in North America a remarkable species has been found in Lake Champlain, Lake Erie, Lake Ontario and the Ohio River, which truly belongs to this family and has generally been referred to the genus *Corvina*, under the name of *Corvina oscula*. It should however be remarked that this species is but remotely allied to the genus *Corvina* and must in reality be considered as the type of a distinct genus, which has already been characterized, thirty-four years ago by that indefatigable naturalist, Rafinesque, under the name of *Ambloodon*. Nobody has however thus far taken the trouble to examine the value of this genus, nor even to state on what ground it has been rejected by those who have incidentally noticed it as a synonym of *Corvina*. The truth is that Rafinesque was right in considering this *Corvina oscula* as a distinct genus, the characters of which he has well defined, as may be seen by comparing his description in the *Ichthyologia Ohiensis* with that below. Moreover I have lately ascertained that there are several

species of *Amblodon* in different parts of the United States and that this type is not limited to the Northern States but extends west as far as the western parts of Missouri and South as far as Louisiana and Alabama.

*AMBLONDON, Rafin.*—External characters of *Corvina*, combined with the form and appearance of *Pogonias*. Upper pharyngeals distinct, covered with broad, hemispherical teeth closely set, like pavement stones and arranged in regular rows; outside of these are a few small pointed teeth. The lower right and left pharyngeals are soldered together into a broad triangular plate, covered with teeth of the same kind and arranged in the same manner as upon the upper pharyngeals. In the genus *Corvina* the lower pharyngeals are distinct as the upper ones and support short conical teeth not numerous, nor closely set. From want of a sufficient number of specimens I am unable to determine whether the specimens from the great Lakes are specifically identical with those of the Ohio River described by Rafinesque as *Amblodon grunniens*; but I have ascertained that the species of the Ohio River differs from that of Huntsville, which I call *Amblodon concinnus*, Agass. This species differs from *A. grunniens* in having the body less elongated, the profile steeper, and the dorsal fin placed further forwards. The profile is most arched immediately over the upper attachment of the preopercle, in *A. grunniens* it is most prominent over the opercle. The dorsal fin ends slightly in advance of the base of the pectorals; in *A. grunniens* behind these. The serrated edge of the preopercle is directed more obliquely downwards and backwards, making the inferior angle of the preopercle more acute. This species is known in the Tennessee River by the name of Drum. It reaches there the weight of fifty pounds.

*Amblodon lineatus*, Agass.—This species sent to me by Mr. Geo. Stolley from the Osage River, Mo., resembles more *A. concinnus* than *A. grunniens*, but the head is shorter; the prominence of the forehead is nearer the dorsal fin, immediately over the opercle, thus having a less arched profile. The anterior border of the eye nearly reaches the profile of the head. The spines of the dorsal fin are bent more backwards. The dark coloration of the centres of the scales, especially in younger specimens produces the appearance of regular lines following the direction of the rows of scales, hence the name of this species. It grows also very large, and bears in Missouri the same name of Drum as the species of the Tennessee River. Mr. Stolley informs me that the *Amblodons* are very sluggish, and live at the bottom of muddy waters, where they are often seen progressing slowly, raising as it were, clouds of dirt before them, now lying

upon one side of their body, then turning upon themselves or plunging headlong into the soft ground with their body in a vertical position. They feed upon worms, and small shells, large numbers of which are often found crushed to pieces in their stomach; they however bite occasionally at a minnow.

*ESOCES*, *Cuv.* (Joh. Müller.)—Though we have only the genus *Esox* representing this family in North America, it is perhaps not superfluous for me to state that I agree with the modifications J. Müller has introduced in this group since it was first established by Cuvier. We have one species from the Tennessee River, called Pike at Huntsville.

*Esox crassus*, Agass.—This species agrees fully with the type of *Esox reticulatus* in having both the operculum and cheeks covered with scales. It is, however, a much deeper fish than *E. reticulatus*; its scales are larger and nearly of an hexagonal form. The scales of the preopercle and cheeks are as large as those of the body; those on the opercle are smaller. The superior orbital ridges are more prominent; the depression between these ridges is deeper. The anal and caudal fins are shorter. The body is marked as in *Esox reticulatus*. The genus *Esox* has a very wide range in North America, but there is no difference of structure between those of the Canadian Lakes and the western waters, and those of the Atlantic lakes and rivers, as Mr. Girard affirms in a notice recently published in the Proceedings of the Academy of Natural Sciences in Philadelphia (1853, page 386). In the first place my *Esox Boreus*, from Lake Superior, does not belong to the same type as *Esox Estor*, its cheeks being covered with scales. Moreover, I know already three species from the western waters, one of which is noticed above, the cheeks and operculum of which are as completely covered with scales as in *Esox reticulatus*. There are in reality more species of the type of *Esox reticulatus*, in the western waters and the Canada lakes, than of the type of *Esox Estor*, and far from excluding one another these types occur there together. As to the application of the names Pike and Pickerel to the different type of our *Esoces*, it cannot be justified, since such a use would be a scientific sanction of the misapplication of English names to our native animals, which has already led to so much confusion. Unless applied as a generic appellation, the name *Pike* must be retained for the European *Esox Lucius*, to which only it belongs by right; whilst the name *Pickerel* designates the young of that fish. It would be quite as advisable to introduce in our scientific nomenclature the name of *Calf* to distinguish the Bisons from the type of our domesticated cattle, as to apply the name *Pickerel* to any particular species or set of species of the genus *Esox*.



**CYPRINODONTS, Agass.**—Only two species of this family have thus far been discovered in the waters of the Tennessee River, and both of them have already been described by Dr. Storer under the names of *Pæcilia catenata* and *olivacea*, Synopsis, p. 178. Having made lately however, a thorough revision of the genera and species of this family found in the United States, I would remark that *Pæcilia catenata*, St., ought to be referred to the genus *Hydrargyra*, and that *Pæcilia olivacea* belongs to my newly established genus *Zygonectes*. These species ought therefore to stand in future in our systematic catalogues under the names of *Hydrargyra catenata*, and *Zygonectes olivaceus*.\*

**CYPRINOIDS, Cuv.**—This is one of the most interesting families of our freshwater fishes, both on account of the number of genera and species inhabiting our lakes and rivers, and of the diversity of their forms and habits.

**CARPIODES, Rafin.**—In the great French Ichthyology, Valenciennes has established a new genus under the name of *Sclerognathus*, for Lesueur's *Catostomus cyprinus*, and this genus has deservedly been acknowledged by subsequent writers. In considering this type of Cyprinoids as a distinct group among the Catostomi, Rafinesque has however the priority over the able professor of the Jardin des Plantes; for we find in his *Ichthyologia Ohiensis* that the third subgenus of *Catostomus*, which he

\* The species of the genus *Zygonectes* may be arranged in two groups: 1. those in which there are several more or less distinctly dotted lines along the sides of the body, and in which a broad black band extends across the eye and cheek. To this group belong: *Z. Nottii*, Agass. The darker continuous longitudinal lines alternate with fainter interrupted ones. Males with distinct, transverse bands. Dark olive above, fading upon the sides, silvery below. Operculum, throat, and space in advance of the eye light orange color. Mobile, Alabama. Collected there with Dr. Nott. Mississippi: Col. Deas.—*Z. lineolatus*, Agass. Longitudinal lines broader and undulated or serrated, the transverse bands of the male very distinct and broader than the longitudinal ones. Olive colored, darker along the back and fading upon the sides, lower parts silvery. Discovered by Dr. W. I. Burnett at Augusta, Ga.—*Z. guttatus*, Agass. A large dark spot upon the centre of each scale on the back and sides, forming longitudinal rows of disconnected dots. The transverse bars of the males are much narrower and nearer together than in *Z. lineolatus*. Dark olive above, fading upon the sides; abdomen silvery. Mobile, Alabama.—*Z. dispar*, Agass. Longitudinal lines of minute dots particularly distinct in the anterior part of the body, alternating backwards with continuous lines in the males, which are besides transversely barred, whilst the female has only continuous serrated lines upon the sides. Light olive above, silvery upon the sides and below. In small creeks near St. Louis, Mo., on the Illinois side of the Mississippi, and also in the Illinois River at Beardstown.—*Z. hieroglyphicus*, Agass. Anterior and upper part of the body irregularly sprinkled with dark spots, passing into longitudinal rows backwards. Light olive above, silvery upon the sides and below. Mobile, Alabama. 2. The second group includes species with one broad longitudinal black band extending from the tip of the lower jaw to the base of the tail, passing in a straight line through the eyes and along the sides of the body. To this group belongs the species mentioned above from the Tennessee River, and also *Z. lateralis*, Agass, which is a more elongated species from Mobile, Alabama; also dotted above the broad lateral band, and *Z. zonatus*, Agass, from St. Louis, Mo., which has no spots upon the sides of the back, and in which the outlines of the longitudinal band are serrated.

calls *Carpiodes*, though not characterized with the precision with which Valenciennes has circumscribed his genus *Sclerognathus*, exactly corresponds to it. I do not hesitate therefore to adopt Rafinesque's name as the older; the more so, since this writer has at the same time wisely separated from the common *Catostomi* at that early day two other types of the same group, which are even now left among *Catostomi* by all ichthyologists. I allude to the subgenus *Ictiobus*, with *Catostomus Bubalus* as its type, and to the genus *Cycleptus* for the *Missouri sucker*; for though Rafinesque did not himself examine this latter fish, and ascribes to it two dorsals, it must be evident to any one who has had an opportunity of investigating this rare species that the few words with which it is mentioned apply to it, and that the indication of two dorsals is easily explained by the very form of that fin, the anterior part of which rises like a separate fin in advance of the following low part which extends uniformly far behind. I should add that *Catostomus elongatus* belongs also to this genus *Cycleptus*. As to *Ictiobus*, it resembles *Carpiodes* in external appearance, but is at once distinguished by its thin lips and more terminal mouth.\* Nothing is to be more regretted for the progress of Natural History in this country, than that Rafinesque did not put up somewhere a collection of all the genera and species he has established, with well authenticated labels, or that his contemporaries did not follow in his steps, or at least preserve the tradition of his doings, instead of decrying him and appealing to foreign authority against him. Tracing his course as a naturalist during his residence in this country, it is plain that he alarmed those with whom he had intercourse by his innovations and that they preferred to lean upon the authority of the great naturalists of the age then residing in Europe, who however knew little of the special Natural History of this country, than to trust the somewhat hasty man who was living among them, and who had collected a vast amount of information from all parts of the States, upon a variety of objects then entirely new to science. From what I can learn of Rafinesque, and from a careful study of his works, I am satisfied that he was a better man than he appeared. His misfortune was his prurient desire for novelties, and his rashness in publishing them, and yet both in Europe and in

\* In connection with the genera mentioned above, I may remark here that Rafinesque has established another sub-genus under the name of *Morostoma*, which fully deserves to be recognized as a distinct genus, as far as I am able to judge from the three species belonging to it, with which I am especially acquainted, which are *Catostomus anisurus* of the West, *C. gibbosus* or *tuberculatus* of the East, and *C. Saceti* of the South. After acknowledging these alterations of the genus *Catostomus*, as it is now generally understood by ichthyologists, there would still remain a group of species to constitute the genus *Catostomus* proper of which *C. hudsonius*, for which the name *Catostomus* was first proposed, may be considered as the type. Thus freed of all unjustifiable additions engrafted upon it in course of time, the genus *Catostomus* would be restored to its primitive natural circumscription.

America he has anticipated most of his cotemporaries in the discovery of new genera and species in those departments of science which he has cultivated most perseveringly, and it is but justice to restore them to him, whenever it can be done. Personal considerations should no longer be allowed to interfere with this late act of redress. May the example of Rafinesque not be lost for those naturalists in this country who describe new species without taking the least care to preserve the original specimens of their descriptions, or to circulate authentic ones among other naturalists.

Besides the well known type of the genus *Carpiodes*, the *C. Cyprinus*, and the other species described by Valenciennes and Rafinesque, I have ascertained the existence of five undescribed species, of which I give below short comparative descriptions. These species bear to one another similar relations as the species of *Cyprinus* described by Heckel; indeed they truly represent upon the Continent of North America the genus *Cyprinus* of the old world to which they bear the greatest resemblance in outward appearance, though they differ strikingly in their generic characters. I have applied to the new species here mentioned names reminding us of the common name of Buffalo applied to all of them throughout the country. The large number of specimens including all sizes, which I have been able to collect of some species of this genus, has enabled me to ascertain the range of variation in their characters.

1. *Carpiodes Urus*, Agass.—From the Tennessee River. It grows very large, weighing occasionally from 30 to 40 pounds. The body in this species is not so high as in *C. Cyprinus*, nor is it so compressed above; the scales are also not so high, but more angular behind, and the anterior portion of the dorsal is not so elongated. The gill cover is larger, and the distance from the hind border of the eye to the inferior angle of the subopercle, near the base of the pectorals, and the distance from the same point to the superior and posterior angle of the opercle, are nearly equal. In *C. Cyprinus* the distances differ by nearly one-third. The subopercle is not triangular, but its hind border is nearly regularly arched from the upper angle to the posterior angle of the interopercle. The anal has its posterior margin full, and not lunate; the caudal is not so deeply furcate as in *C. Cyprinus*. The ventrals do not reach the anal. All fins are of a dark color. I am indebted to Dr. Newman for this species.

2. *Carpiodes Taurus*, Agass.—From Mobile River, Alabama. The form of the body is intermediate between that of *C. Cyprinus* and *C. Urus*. The gill cover has the same form as in *C. Urus*, but it is larger and more strongly arched behind. The hind margin of the scales is waving, owing to a somewhat prom-



inent middle angle. The anterior rays of the dorsal equal in length two-thirds of that of the base of the fin. Anal not lunate behind. The ventrals do not reach to the anal opening. Caudal not so deeply furcate as in *C. Cyprinus*.

3. *Carpiodes Bison*, Agass.—From the Osage River, Missouri. This species is more elongated than *C. Taurus*. The head is smaller, the opercle also smaller, and the subopercle triangular. The dorsal has its anterior rays longer, hence its hinder border is more deeply emarginate. Anal more deeply lunate. Horizontal diameter of scales greater. I have received this species through the attention of Mr. George Stolley.

4. *Carpiodes Vitulus*, Agass.—From the Wabash River, Indiana. This seems to be a smaller species than the preceding ones. The form of the body resembles that of *C. Taurus*; but the eyes are smaller; the opercle is more broadly rounded behind; the subopercle has its posterior and free border regularly arched above and below, and not emarginate as in *C. Taurus*. The direction of the numerous water tubes on the head and cheeks also differ. The upper and lower borders of the scales are nearly straight. The dorsal does not extend quite so far forwards. I am indebted to Col. Richard Owen of New Harmony for this species.

5. *Carpiodes Vacca*, Agass.—From the Susquehannah River. This species resembles more closely *C. Cyprinus* than any other; the anterior rays of the dorsal are also very elongated, yet they do not reach beyond the base of the fin itself when bent backwards; the caudal is not so deeply furcate, and the scales have a greater horizontal diameter. I owe this species to the kindness of Professor S. S. Haldeman.

*CATOSTOMUS*, Lesueur.—The following species of this genus have been collected by Dr. Newman in the vicinity of Huntsville:

*Catostomus communis*, Lesueur.—Called Fine-scaled Sucker at Huntsville.

*Catostomus nigricans*, Lesueur.—Called Hog Sucker at Huntsville.

*Catostomus Duquesnii*, Lesueur.—Called May Sucker at Huntsville.

*Catostomus melanops*, Kirtl.—Also called May Sucker at Huntsville. This species agrees with Kirtland's description of *C. melanops*, except in having longer pectorals and in the reddish color along the sides. Rafinesque's description cannot apply to this fish. Having no specimens from the localities mentioned by Rafinesque and Kirtland, I do not venture to pursue further a comparison between these fishes.

*RHINICHTHYS*, Agass.—This genus was established by me in "Lake Superior," page 353. Several new species have been dis-

covered since by Prof. Baird and myself.\* Dr. Newman has sent me another undescribed species, which I call

*Rhinichthys obtusus*, Agass.—Body cylindrical, slightly compressed, more blunt than in *Rh. marmoratus*. The mouth extends but little beyond the margin of the upper jaw; lower jaw strongly arched from side to side. Eyes rather large and nearer the end of the snout than the posterior angle of the opercle. Dorsal exactly intermediate between the ventrals and the anal, quadrangular, its last rays about two-thirds the length of the fish, so that when the fin is folded backwards their ends meet. Pectorals broadly rounded behind; do not reach the base of the ventrals. Caudal not very deeply furcate; its lobes are broad, rather than slender, the lower lobe is generally a little the longer. The color of the body is dark chocolate above, and of a silvery white below; these two colors are separated by a longitudinal band of a darker color than the back, extending from the end of the snout through the eye in a direct line along the sides to the middle of the base of the caudal. The whole dorsal region is mottled with black blotches, sometimes running together and forming large patches, and often descending to the lighter portion of the sides. Scales rather small. Called Minnow at Huntsville. Found in the Spring branch.

*CHONDROSTOMA*, Agass.—This genus was established by me in 1834 in the *Mémoires de la Société des Sc. Nat. de Neuchâtel*, for the *Cyprinus Nasus* of Europe, and has been adopted with various modifications by subsequent writers. Thus far no representative of this type had been known to exist in North America, though the species I now refer to it here, has been described for sometime by Dr. D. H. Storer; but having been referred to the genus *Leuciscus*, to which *C. Nasus* was also referred formerly, it has not been distinguished from the ordinary *Leucisci*. I need only allude to it for the present.† Other species occur in the fresh waters of the Pacific coast of North America. *Exoglossum dubium*, Kirtl., may belong to this genus.

*Chondrostoma prolixum*, Agass.—*Leuciscus prolixus*, Storer, Synops., page 165. Called Minnow at Huntsville. Found in the Spring branch.

\* I am indebted for another new species of this genus to Dr. J. H. Rauch, of Burlington, Iowa, which I would call *R. Meleagris*, Ag. It is remarkably short and stout in comparison to its congeneric types, also smaller. The whole body is dotted with black upon a silvery ground, the dots partly confluent; the belly only is plain silvery white.

† I owe another entirely new species of this genus to Dr. J. H. Rauch, of Burlington, Iowa; which I inscribe as *Ch. pullum*, Ag. It is the smallest species of the genus; much broader than the others in comparison to its length; head especially small, almost indicating distinct generic peculiarities, into which I am however unable to enquire from want of a sufficient number of specimens. This pretty little fish is of a peculiar deep but dull green, darker above, passing into yellowish white below.

*HYBOPSIS*,\* Agass.—So little attention has thus far been paid to the generic differences existing between the American Cyprinoids that it is not surprising to find several yet unnoticed. Among others I mention here a new type remarkable for its slender elongated form, its long head, its obtuse prominent snout, its inferior mouth and the advanced position of the anal. This genus is founded upon a small species from Huntsville. *Leuciscus Storerianus*, Kirtland, which I have however not examined in nature, may be another species.

*Hybopsis gracilis*, Agass.—Body much elongated and slightly compressed; head long, equalling nearly one-fourth the entire length of the fish. The snout is very short and broadly rounded; the nostrils are large, above the middle line of the eye and nearer the end of the snout than the centre of the eye. The eyes are very large in proportion to the size and width of the head; the horizontal diameter which is slightly the longest, equals one-third the length of the head, their upper edge is on a line with the top of the head, the lower edge with the anterior edge of the intermaxillaries and the extremity of the upper maxillaries reaches the line of their anterior border. The fins are all long and pointed. The pectorals are low down on the sides and reach the base of the ventrals. The hinder base of the dorsal is midway between the end of the snout and the extremity of the tail. The height of the dorsal is one-third greater than the length of the base; the second and the third rays longest; number total of rays 8, and two united as one for the last ray of the fin. The base of the ventrals is below the anterior part of the dorsal; their extremities reach nearly to the anal fin. The distance of the anal from the base of the tail is equal to twice the length of its own base. The anal is like the dorsal in form, but smaller, number of rays 7, with a last double ray. Caudal long, deeply furcate, the lobes being slender and pointed.

*CHROSOMUS*, Rafin.—The fish for which Rafinesque established this group in his genus *Luxilus*, well deserves to be considered as

\* While these pages were setting in type, I have received another pretty species of this interesting genus, through the attention of Dr. I. H. Rauch, from Burlington, Iowa. The large number of specimens obtained enables me to make some additions to the characteristics of the genus: "The mouth is protractile downwards, after the fashion of *Catostomus*, so much so that had I not had ample opportunity to examine young *Catostomi*, and to study the changes they undergo with age, I might have supposed my *Hybopsis* to be the young of some species of that genus. Moreover the lips are not swollen nor thickened. The pharyngeal teeth differ also greatly from those of *Catostomi*, there being only four or five compressed and hooked ones in each main row, and one or two in a second row."

This new species differs from that of Huntsville, by its smaller size, its more pointed snout and the peculiar coloration. A deep black narrow band extends from the neck to the base of the caudal along the whole back, dividing in advance of the dorsal to encircle that fin, and uniting again behind it upon the middle line. General color olive, silvery upon the sides, the dorsal and caudal faintly tinged with rose color and a deeper rose-colored spot upon the base of the first ray of the dorsal. I shall call this species *H. dorsalis*, Ag.



a distinct genus, as it stands very isolated among the other American Cyprinoids. It may be considered as corresponding upon this continent to the genus *Phoxinus* of Europe, from which it differs however by the continuous lateral line and the shorter lower jaw. Rafinesque has given it a very appropriate specific name, calling it

*Chrosomus erythrogaster*, Raf.—It is one of the prettiest fresh-water fishes of North America, varying greatly with age and at different periods of the year. It remains yet to be ascertained whether the specimens from the Tennessee River are strictly identical with those from the Ohio River. I have received specimens from the Osage River, from Mr. G. Stolley, which differ somewhat in having deeper colors and a somewhat elongated form.

STILBE, *DeKay*.—In his Natural History of New York, DeKay has established this genus for the *Cyprinus chrysoleucos* of Mitchell. Without a thorough revision of the many new genera of Cyprinoids established by Heckel and Prince Canino, for which I have not the necessary materials on hand, I am unable to decide whether DeKay's genus may stand or not. So much however is certain, that Storer's *Leuciscus obesus* from Florence, Alabama, which has also been obtained in the vicinity of Huntsville by Dr. Newman, also belongs to this genus. *Abramis versicolor*, DeKay, must also probably be referred to it. I know several other undescribed species of this type from other parts of the United States. It is intermediate between *Alburnus* and *Abramis*, having the form of *Abramis elongatus*, and other elongated species of that genus with comparatively small anal, and the prominent lower jaw of *Alburnus*.

*Stilbe obesus*, Agass.—*Leuciscus obesus*, Storer, Synopsis, p. 166. Called Hickory or Gizzard Shad at Huntsville.

HYPSOLEPIS, *Baird*.—This genus was established for those species of *Leuciscus* the body of which is compressed and covered with high short scales. *Leuciscus cornutus* may be considered as its type. My *Leuciscus frontalis* from Lake Superior, is another species of this genus. To it belongs also Dr. Storer's *Leuciscus gibbosus* from Florence, Alabama, which has also been found about Huntsville, by Dr. Newman.

*Hypsolepis gibbosus*, Agass.—*Leuciscus gibbosus*, Storer, Synopsis, page 166. Called Silver-sides at Huntsville.

LEUCISCUS, *Cuv*.—One species from Huntsville, the same which Dr. Storer has described from Florence, Alabama, under the name of

*Leuciscus croceus*, Stor., Synopsis, p. 165.

**SAUROIDS, Agass.**—Before I began to collect the materials for a monograph of the genus *Lepidosteus*, I had no idea of the wide geographical range of this type in North America. Indeed our ichthyological works mention only Lake Huron, Lake Erie and Lake Champlain in the North, the Ohio and Mississippi in the West, and S. Carolina and Florida in the South, as its home, and the whole number of species described, even including all those of Rafinesque without questioning the validity of any of them, does not exceed nine or ten. Yet I have now, in my own collection, not less than twenty-two well characterized species of the genus, and I have ascertained its existence in all the water systems of the South from Florida to Texas, in the Mississippi and all its larger tributaries up to the latitude of Lake Superior, where it does not however occur, in all the lower great Canadian Lakes, and in the St. Lawrence. Also in those river and Lakes of western New York which empty into the waters of the St. Lawrence; in those of western Pennsylvania emptying into the Ohio, and in all the Atlantic rivers, from the Chesapeake Bay to Florida; leaving only the New England States East of Lake Champlain without any of its representatives. Poey describes also one species from Cuba. It seems however to be wanting west of the Rocky Mountains and in Central America. The species sent me by Dr. Newman from Huntsville, agrees with Rafinesque's

*Lepidosteus platostomus*.—It differs however from the species described under the same name by DeKay from Florida, the original specimen of which I have examined myself. Its name at Huntsville is *Gar*.

The identification of species in this genus is extremely difficult owing to the great changes they undergo with age. Indeed the young differ so much in form and structure from the adult that Rafinesque has established a distinct genus for the young of his *Lepidosteus oxyurus* under the name of *Sarchirus vittatus*. In this immature state these fishes have the upper region of the caudal separate from the lower, as a distinct lobe, the body is scaleless and the pectorals consist of a membrane rising from a fleshy tubercle, hence the name *Sarchirus* of Rafinesque. Another peculiarity of the young lies in their coloration; they having mostly a broad longitudinal black band along the middle line. This has for a time led Rev. Z. Thompson to consider the young of Richardson's *Lepidosteus huronensis* as a distinct species which he has described as *L. lineatus*. DeKay's *L. Bison* is also the same species as *L. huronensis*; this differs however widely from the southern *L. osseus* and from Rafinesque's *L. oxyurus* from the Ohio River. I shall take an early opportunity of describing all the species I know of this genus and settling as far as possible their complicated synonymy.

**CCELACANTHIS**, Agass.—Until an extensive and minute comparison of all the representatives of the genus *Amia* from different parts of the United States can be made to ascertain the true value upon which the different species described by Richardson, DeKay and Valenciennes, are founded, it may be sufficient to mention here the existence of that genus in the waters of the Tennessee under the name of

*Amia calva*, L, which has long been considered and may in reality be the only one of the genus. It is known at Huntsville under the name of Scaly Cat and Carp. Found in Mill ponds.

**SILUROIDS**, Cuv.—Two species of this very natural family have been sent to me from Huntsville by Dr. Newman.

*Pimelodus cærulescens*, Rafin.—Channel Cat. Grows very large and weighs occasionally over one hundred pounds.

*Pimelodus Catus*, Lin.—Several species are confounded under this name; but it is impossible to characterize them without entering into details which would be out of place in this short notice. Called Mud Cat at Huntsville.

**STURIONES**, Cuv.—Two species of Sturgeons occur in the Tennessee, specimens of which I have received from Dr. Newman.

*Acipenser rubricundus*, Lesueur.

*Acipenser maculosus*, Lesueur.

These two species have been considered as synonymous by some ichthyologists. It is true that the young *A. rubicundus* like all young Sturgeons are more or less maculate, and yet there are so many other differences between the two specimens I have before me, which are nearly of the same size, that I can hardly consider them as identical. The whole genus requires a thorough revision and would be an interesting subject for a monograph.

There are some genera of North American fresh-water fishes the absence of which surprises me in the collection sent by Dr. Newman, and mention them with the view of calling attention to them more particularly. *Lucioperca*, generally called *Salmon* in the West. Is it not possible that the specimens of *Hyostoma* described above were mistaken for young *Lucioperca* and sent as specimens of the *Salmon*? *Labrax*, known everywhere as White Perch. The presence of the genus *Perca* seems more doubtful. *Chatassus*, generally known as Hickory or Gizzard Shad. I fancy that the *Stilbe obesus* mentioned above, was mistaken for a small specimen of this type. *Hyodon*, known as Toothed Herring. *Anguilla*, the Eel. *Lota*, known as Barbot or Helpout. The genus *Pogostoma*, of Rafinesque, is evidently synonymous with *Lota*. *Polyodon*, known as Shovelbill, and *Petromyzon*, the Lamper-eel. I should also expect a long-billed



species of *Lepidostens*, for the two types of this genus occur everywhere together in the West.

If the study of the geographical distribution of animals is ever to furnish us any indications respecting the circumstances under which organized beings were created, we must, in investigating it, turn our attention particularly to those facts which disclose differences of structure in connection with the special localization of the different representatives of each family within their natural boundaries. For years I have been collecting diligently all the data within my reach bearing upon this question, and from the results of this enquiry already in my possession, I am satisfied that the day is not far distant when we shall know with sufficient precision *where* all the living beings now existing upon earth have made their first appearance. This must of course be the first step towards a deeper insight into the *conditions* of that origin itself.

In connection with this train of thoughts it is interesting to notice how much different families of animals vary from each other in the most prominent features of their geographical distribution. There are those the representatives of which are almost uniformly distributed over the whole range of their natural arena. Such is the family of Salmonidæ proper. There are species of true *Salmo*, of *Thymallus*, of *Coregonus*, of *Osmerus* very equally scattered over Europe, Asia and North America. The same is the case with the family of Esocæ, which has however a much greater number of species in the fresh waters of North America. So are also the Sturgeons, with this difference, that upon the continent of America two peculiar genera, *Scaphirhynchus* and *Polyodon*, are added, which have no representatives in the old world. The Percoids however present very different combinations: some types are common to North America, Europe and Northern Asia, as the genera *Perca*, *Lucioperca* and *Labrax*, with this difference however, that North America has many fresh water representatives of the genus *Labrax* which are wanting in the old world; other types are only to be found either in North America or in the old world,—for instance *Grystes*, *Centrarchus*, *Pomoxis*, *Amploplites*, *Calliurus*, *Pomotis*, have no representatives in Europe where we find in their stead the genera *Aspro* and *Acerina*; the balance being in favor of North America as far as the number and diversity of the fresh-water types of this family is concerned, whilst the old world has many more and more diversified marine representatives. The family of Cyprinoids agrees with that of the Percoids in the features of its geographical distribution; the types peculiar to each side of the Atlantic being however more equally distributed, for whilst in the old world we find the genera *Cyprinus*, *Barbus*, *Tinca*, *Cobitis*, *Pelecus*, *Aspius*, *Rhodeus*, *Phoxinus*, North America has its *Car-*

piodes, Ictiobus, Cycleptus, Catostomus, Rhinichthys, Chrosomus, Hypsolepis, Hybopsis which are foreign to the old world, and they share together the genera Alburnus, Chondrostoma, Leuciscus, &c., still, with this difference, that the true Leucisci are far more numerous in the old world than in North America. In the family of Cyprinodonts we find exactly the reverse, there being in North America a much greater diversity and a larger number of representatives of this type than in the old world. The case is still different with the family of the Etheostomoids; which are altogether peculiar to North America, not a single species being known in the old world. The family of Cœlacanth is also entirely foreign to the old world, whilst the Sauroids are represented by one genus, Polypterus in the old world and by another, Lepidosteus in America. The Sciænoids differ in another respect: whilst these fishes inhabit exclusively the sea in the old world, there are in North America besides many marine representatives, a number of fresh-water species constituting a distinct genus, Amblodon. Again the family of Siluroids, is represented by a great variety of species in North America, and only by a few in the old world. Similar facts might be mentioned of other families, but this may be sufficient to show how important it is to combine the study of the modifications of the structure of animals with that of their geographical distribution.

For it is not the presence here or there of this or that species of any genus, or family or higher group which I would particularly consider in the study of the geographical distribution of organized beings, but the localization upon certain parts of the surface of the globe of special modifications of definite types representing each a distinct idea, expressed in a variety of living forms and combined in various ways in time and space.

There is another point of view of equal interest in this connection; the mode of association of different families in different parts of the world. It is a fact for instance that the Goniodonts are limited to South America, and that this family, which is entirely wanting in the old world, has no nearer relative than that genus of Sturgeons peculiar to North America, the Scaphirhynchus. Again, whilst the families mentioned above as characteristic of the North American fresh-water fish fauna seem to be equally distributed over the surface of this vast continent, there is yet a special adaptation of some of their types to peculiar localities. The great similarity of their representatives throughout the Southern Atlantic States, the Gulf States and the Mississippi Valley, as high up as the Ohio, including even Lake Champlain, does not extend to the New England States, which although encircled by this uniform combination of fresh-water animals, have another zoological character, peculiar to itself, and approximating more to that of the old world under the same climatic conditions

than the western and southern parts of the Union. In this isolated region of North America, in this zoological island of New England, as we may well call it, we find neither *Lepidosteus*, nor *Amia*, nor *Polyodon*, nor *Ambloplites*, nor *Grystes*, nor *Centrarchus*, nor *Pomoxis*, nor *Ambloplites*, nor *Calliurus*, nor *Carpoides*, nor *Hyodon*, nor indeed any of the characteristic forms of North American fresh-water fishes, so common everywhere else, with the exception of two *Pomotis*, one *Boleosoma*, and a few *Catostomus*. The study of these features is of the greatest importance, inasmuch as it may eventually lead to a better understanding of the intentions implied in this seemingly arbitrary distribution of animal life.

Before closing this notice I would remark that there is still another very interesting problem respecting the geographical distribution of our fresh-water animals, which may be solved by the further investigation of the fishes of the Tennessee River. This water course, taking the Powells, Clinch and Holston Rivers as its head waters, arises from the mountains of Virginia in latitude  $37^{\circ}$ , it then flows S. W. to latitude  $34^{\circ}25'$ , when it turns W. and N. W., and finally empties into the Ohio under the same latitude as its sources in  $37^{\circ}$ . The question now is this: Are the fishes of this water system the same throughout its extent? in which case we should infer that water communication is the chief condition of the geographical distribution of our fresh-water fishes. Or do they differ in different stations along its course? and if so, are the differences mainly controlled by the elevation of the river above the level of the sea, or determined by climatic influences corresponding to differences of latitude? We should assume that the first alternative was true if the fishes of the upper course of the river differed from those of the middle and lower course in the same manner as in the Danube, from its source to Pesth, where this stream flows nearly for its whole length under the same parallel. We would on the contrary suppose the second alternative to be well founded, if marked differences were observed between the fish of such tracks of the river as do not materially differ in their elevation above the sea, but flow under different latitudes. Now a few collections from different stations along this river, like that sent me by Dr. Newman from the vicinity of Huntsville, would settle at once this question, not for the Tennessee River alone, but for most rivers flowing under similar circumstances upon the surface of the globe. Nothing, however, short of such collections, compared closely with one another, will furnish a reliable answer. I know already from a mere catalogue of the vernacular names of the fishes from the vicinity of Jonesboro, sent me by Dr. Cunningham, and from a few specimens collected by Prof. Erni, late of Knoxville, that the fishes of the upper and lower course of the Tennessee differ greatly from



each other, without being able to tell exactly how, from want of specimens. To set this question completely at rest, it would be best to obtain collections from the different tributaries of the Tennessee, as well as from the main stream, one from the Powells, one from the Clinch, one from the Holston, one from the French Broad, &c., and from the main river, one from the vicinity of Washington, Tenn., or from Chattanooga, another from Florence, (the Muscle Shoal being the point, as I am informed by Dr. Newman, above which fish do not migrate in the Tennessee,) and another anywhere above its junction with the Ohio, perhaps best about Reynoldsburg, at some distance from the Ohio. Whoever will accomplish this survey will have made a highly valuable contribution to our knowledge.

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APPENDIX.—*Additional Notes on the Holconoti.*

HAVING lately received a large number of specimens of *Holconoti*, from California, through the kindness of my friend, T. G. Cary, Esq., of San Francisco, I avail myself of this opportunity to make several additions to my first notice of that remarkable family. As I had anticipated, the number of species belonging to it is rapidly increasing. I have now no less than six distinct species before me, presenting even a far wider range of differences than I was prepared to find among them, which has led me to establish several new genera, besides *Embiotoca*. Respecting the family characters, I have to add that there is *another space deprived of scales, extending along the middle line of the belly, from the sides of the ventrals to the base of the anal*, undoubtedly a provision to facilitate the dilatation of the abdominal cavity during the growth of the astonishingly large young of these fishes. It is rather surprising, however, that this scaleless space exists also in the males, and this might be considered an objection to the explanation just given, did we not find also tits and mammary glands in the males of *Mammalia*. Nevertheless *the males and females differ widely from one another*, in each of the four species of which I have thus far been able to obtain both sexes. This circumstance adds greatly to the difficulty of distinguishing and characterizing the species. The males are uniformly smaller than the females, contrary to what has been observed in the genus *Pœcilia*, in which the males (*Mollinesia*) and the females (*Pœcilia*) differ so much as to have been considered as distinct genera, but agreeing in this respect with my genus *Heterandria*, in which the males are also smaller than the females. The difference consists chiefly in the peculiar form of the anterior part of the anal in the males, which resembles somewhat that of the male of *Mallotus villosus*, being more rigid and more expanded than in the females. The jaws are more or less protractile. Air bladder large and simple. In

males the sexual aperture is at the summit of a projecting conical papilla. The genus *Embiotoca* as first established, does not require modifications; I have only to add a new species to it, and to mention some features by which it differs from the following genera: The spinous portion of the dorsal is uniformly low, so that the soft portion rises abruptly to a much greater height; the anterior *articulated* rays of the anal *simple* and *not branching* at their extremity. In the male the anterior articulated rays of the anal are swollen near their base, forming a continuous longitudinal ridge on each side of the fin. This ridge is variously modified in the different species. The jaws are moderately protractile; the lower lip is fixed by a frenum to the symphysis of the lower maxillaries, and not free and moveable all round the jaw. The young of the third new species of this genus resembles exactly those of the two formerly described, but differ remarkably from those of another species belonging to a new genus which I shall mention below, thus showing that there are generic modifications in the growth of the young, though the mode of reproduction is exactly the same in all. In *Embiotoca* proper, the young resemble most remarkably the mother, about the time of their escape from their confinement, except in color; in addition to the peculiarities described in my former paper, I would mention a large black diffused spot upon the anterior part of the soft portion of the dorsal and of the anal, which is found in the *young* of all three species of this genus, whilst *E. Caryi* alone shows signs of it *when full grown*. The male papilla is rather large.

*Embiotoca Caryi*.—I possess the most complete series of this species, for besides two pregnant females with young ready to escape, caught in July, I have males and females of various sizes caught in January; at this period the marsupial sac is reduced to a fusiform tube, extending from the sexual aperture to the anterior extremity of the air bladder, but the state of preservation of the intestines did not allow a minute examination of its structure. The male, which is more elongated than the female, has also much brighter colors: the longitudinal and transverse bands of the body are more distinct, the black specks upon the soft dorsal and the anal are more brilliant, and the cheeks, opercule, jaws and chin are adorned with bright blue blotches more or less confluent: the ground color of the body seems to vary from olive on the back to a yellow-orange upon the sides.

*Embiotoca Jacksoni*.—The form of the male does not differ quite as much from that of the female in this species, as in the preceding, though it is also slightly narrower. The color, as far as I can judge from alcoholic specimens, is of a deeper olive green, whilst the female is more yellowish.

*Embiotoca lateralis*, Agass.—Resembles closely *E. Jacksoni* in general form and appearance, but seems to bring forth its young

at an earlier period, for among several specimens caught in July, only one was full of young, and that was a younger specimen. The body is dark olive above; sides with alternate silver-gray and rusty bands; fins brown. In younger specimens the longitudinal bands are more yellow, and the fins also yellowish.

*RHACOCILUS*, Agass.—In this genus the vertical fins have the same structure as in *Embiotoca* and the sexes differ in the same manner; but the jaws are very protractile, almost as in our southern *Lachnolæmus*, and the lips very fleshy, the lower lip especially broad, lobed and have their outer margin free from the jaw bone all round, and not attached by a frenum to the chin, as in *Embiotoca* and *Amphistichus*. Teeth few and only in front of the jaws, and none on the sides. The body is also more elongated. The young differ widely from those of the preceding genus: their form is more elongated, the caudal remarkably large and long and truncate at its extremity, whilst it is forked in *Embiotoca*; and the extremities of the dorsal and anal extend beyond the base of the caudal, whilst in *Embiotoca* they do not even reach it; finally there is no black speck upon either the dorsal or the anal.

*Rhacochilus toxotes*, Agass.—Color uniform olive above; sides silvery with light longitudinal bands; female darker than male; vertical fins and ventrals dark; male blackish upon opercule and cheeks. Female with mature young in July.

*AMPHISTICHUS*, Agass.—The spinous rays of the dorsal shorter than the soft rays, but gradually increasing in length, so that the soft portion of the fin does not rise abruptly higher than the spinous portion, though the anterior soft rays are the longest of the fin. Articulated rays of the anal *all divided*, and not simple in front as in *Embiotoca*, nevertheless the fin is separated into an anterior and a posterior portion, by the introduction in the *male* of a short flat-triangular ray, which produces a deep emargination in the outline of the fin, and in the *female* by the presence of two or three articulated rays of equal length with the others but much *stouter* and *oftener divided*. In the male the anterior rays are swollen as in *Embiotoca* and *Rhacochilus*. Papilla of the males very large. Jaws little protractile; with two rows of teeth above and below, lips thin, lower lip not free in the middle. The young have not been observed, the specimens obtained having been caught in January.

*Amphistichus argenteus*, Agass.—Bluish gray above, sides silvery with occasional indistinct and irregular transverse bands of olive color. Vertical fins yellowish.

*HOLCONOTUS*, Agass.—Dorsal long, and lowest behind, its spinous rays being the longest; the anterior and posterior parts of



this fin are not separated by a depression, but its outline descends regularly from the fourth or fifth anterior spinous rays to the posterior extremity. Structure of the anal the same as in *Amphistichus* but proportionally longer; the sexes differing also in the same manner. Young not known, the female obtained having been caught in January. Jaws very slightly protractile, lower jaw projecting; two rows of teeth in the upper jaw only. Lips not fleshy; lower lip free all round.

*Holconotus rhodoterus*, Agass.—Bluish gray above, silvery upon the sides with rose colored spots in irregular longitudinal lines; vertical fins, especially the caudal, reddish.

I have just been informed (February 28th) that the California Academy of Natural Sciences claims for Dr. W. P. Gibbons the discovery of the viviparous fishes upon which I had established the family *Holconoti* and the genus *Embiotoca*; but upon what ground I am not informed. This is a question in which I am entirely disinterested, having thus far been only the historian of the discovery and the biographer and godfather of the fishes. Dates and reference to other publications which may have been made in California, will easily settle the question of priority which as far as the discovery of the viviparity of these fishes is concerned, rests between Mr. Jackson and Dr. Gibbons, and not with me. I learn also, from the same quarter, that Dr. Gibbons has dedicated to me a new species of this family and that the California Academy has inscribed another species to him; but I have not yet seen descriptions of them. Should either of these species coincide with one or the other of those described above, I shall of course adopt, in the more elaborate paper, accompanied with figures, which I am now preparing upon this family, the names first established in accordance with the rules of our science.

The knowledge of this curious family is likely to lead to many other interesting disclosures. Dr. Thom. H. Webb, one of the scientific corps of the Mexican Boundary Line Commission, has sent me under date of Dec. 9th, 1853, the following abstract from his diary, dated San Diego, May 3, 1852: "Capt. Ottinger, of the U. S. Revenue service, caused his seine to be drawn for us to-day. Caught many Tiger and Shovel-nose sharks, two flounders, . . . also a number of small fish, about two or three inches long, *each of which contained ten or twelve living young.*" He adds: "The viviparous progeny I exhibited to the Commissioner and several of the gentlemen of the Commission; and I also kept quite a number of them alive, in a vessel of water, for some days. In the mother they were not, so to speak, indiscriminately huddled together, but methodically arranged, and so placed in relation to each other as to form a compact series, without the loss of interstitial space, in other words, so disposed as to best accommodate the family. On leaving San Diego, I took extra pains to preserve

specimens of this fish, but these special efforts proved an injury," &c. We may therefore confidently look forward for some new type of viviparous fish from San Diego. Mr. Wm. Couper of Toronto, Canada, writes me also that an intelligent young man residing in Buffalo, New York, obtained some fish taken at Black Rock, in which a number of young were found enclosed in a pouch attached to or near the back bone, resembling the parent in form. May this not be some Cyprinodont? I am inclined to believe it, since I have of late ascertained that many of our representatives of that family, if not all, bring forth living young, though these are very small at the time of their birth.

That among our Sharks the Dogfish (*Acanthias americanus*, St.), is viviparous, has long been known. So is also *Mustelus Canis*, Mitch. But Mr. Thayer S. Abert, of the U. S. Engineers, informs me that the Stingray of the coast of North Carolina also brings forth living young. This would be, as far as I know, the first example of a viviparous species in the family of Rays.

